

What is claimed is:

1. A packet transfer method comprising the
2 steps of:
3 causing a transmission-source access network
4 to generate a packet to be transferred to a destination
5 access network and transmit the packet to a
6 transmission-source packet transfer apparatus connected
7 to said transmission-source access network;
8 causing said transmission-source packet
9 transfer apparatus to convert the packet transmitted
10 from said transmission-source access network into a
11 superpacket having a length n times (n is an integer of
12 not less than 2) larger than a fixed-length cell as a
13 switching unit of relay means arranged on a network
14 serving as a backbone, and send the superpacket to said
15 network;
16 causing said network to relay the superpacket
17 using said relay means and transfer the superpacket to a
18 destination packet transfer apparatus connected to said
19 destination access network; and
20 causing said destination packet transfer
21 apparatus to reassemble the packet generated by said
22 transmission-source access network on the basis of the
23 superpacket transferred from said network and send the
24 packet to said destination access network.

2. A method according to claim 1, further

2 comprising:

3 causing said transmission-source packet
4 transfer apparatus to individually store the transmitted
5 packets in units of destination packet transfer
6 apparatuses, form the superpacket for each destination
7 packet transfer apparatus, and send the superpacket to
8 said network, and

9 causing said destination packet transfer
10 apparatus to individually store the superpackets
11 transferred from said network in units of
12 transmission-source packet transfer apparatuses and
13 reassemble the packet for each transmission-source
14 packet transfer apparatus.

3. A method according to claim 2, further

2 comprising causing said transmission-source packet
3 transfer apparatus to detect for each destination packet
4 transfer apparatus that the superpacket is not formed
5 for a first time-out time, and if a packet is stored in
6 association with said destination packet transfer
7 apparatus without construction, form the superpacket
8 from the packet and send the superpacket to said network.

4. A method according to claim 2, further

2 comprising causing said destination packet transfer
3 apparatus to detect for each transmission-source packet

4 transfer apparatus that the packet is not reassembled
5 for a second time-out time, and if a superpacket is
6 stored in association with said transmission-source
7 packet transfer apparatus without reassembly, discard
8 the superpacket.

5. A method according to claim 1, further
2 comprising
3 when the packet transmitted from said
4 transmission-source access network crosses a plurality
5 of superpackets, causing said transmission-source packet
6 transfer apparatus to divisionally send the packet to
7 said network using the plurality of superpackets, and
8 when the packet in the superpacket transferred
9 from said network crosses a plurality of superpackets,
10 causing said destination packet transfer apparatus to
11 connect packet data crossing the plurality of
12 superpackets to reassemble the original packet generated
13 by said transmission-source access network and send the
14 packet to said destination access network.

6. A method according to claim 1, further
2 comprising:
3 causing said transmission-source packet
4 transfer apparatus to store, as a transmission-source
5 address and destination address in a header of the
6 superpacket, unique network addresses defined only in

7 said network and assigned to said transmission-source
8 packet transfer apparatus and said destination packet
9 transfer apparatus, respectively, and send the
10 superpacket to the network, and
11 causing each relay means in the network to
12 look up the header of the transferred superpacket to
13 specify a relay destination of the superpacket in
14 accordance with the network address assigned to said
15 destination packet transfer apparatus and transfer the
16 superpacket to said destination packet transfer
17 apparatus.

7. A packet transfer apparatus for transferring
2 a packet between an access network for
3 transmitting/receiving the packet and a network serving
4 as a backbone having relay means for relaying the packet,
5 comprising:

6 forming means for converting the packet into a
7 superpacket having a length n times (n is an integer of
8 not less than 2) larger than a fixed-length cell as a
9 switching unit of said relay means, and sending the
10 superpacket to said network; and

11 reassembler means for extracting the packet
12 from the superpacket sent from said network and sending
13 the packet to said access network.

8. An apparatus according to claim 7, wherein

2 said forming means comprises first storage means having
3 queues for storing the packets in units of packet
4 transfer apparatuses arranged between said network and
5 an access network as a destination of the packet, stores
6 the packets in the queues in units of destinations,
7 detects that packets in number necessary for formation
8 of the superpacket are stored, and extracts the packets
9 from the queue to form the superpacket.

9. An apparatus according to claim 8, wherein
2 said construction means comprises, for each queue on
3 said first storage means, first time count means for
4 starting time counting every time the superpacket is
5 formed and detecting an elapse of a first time-out time
6 from the time count start time, and when the elapse of
7 the first time-out time is detected, forms the
8 superpacket from the packets stored in the queue.

10. An apparatus according to claim 9, wherein
2 the first time-out time is determined on the basis of a
3 predetermined minimum band for each traffic on said
4 network.

11. An apparatus according to claim 9, wherein
2 the first time-out time is determined on the basis of a
3 predetermined allowable network delay time for each
4 traffic on said network.

12. An apparatus according to claim 7, wherein
2 said reassembler means comprises second storage means
3 having queues for storing the superpackets in units of
4 packet transfer apparatuses arranged between said
5 network and a transmission-source access network, stores
6 the superpacket in the queue, and reassembles the packet
7 from the stored superpacket.

13. An apparatus according to claim 12, wherein
2 said reassembler means comprises, for each queue on said
3 second storage means, second time count means for
4 starting time counting every time the packet is
5 reassembled and detecting an elapse of a second time-out
6 time from the time count start time, and when the elapse
7 of the second time-out time is detected, discards the
8 superpacket staying in the queue.

14. An apparatus according to claim 13, wherein
2 the second time-out time is determined on the basis of a
3 predetermined minimum band or maximum allowable value of
4 network delay for each traffic on said network, delay
5 distribution time in said network, and predetermined
6 protection time.

15. An apparatus according to claim 7, wherein
2 said forming means detects that the packet

3 crosses a plurality of superpackets and divisionally
4 stores the packet in the plurality of superpackets, and
5 said reassembler means detects that the packet
6 on the superpacket crosses a plurality of superpacket
7 and links packet data divisionally stored in the
8 plurality of superpackets to reassemble the original
9 packet generated by said transmission-source access
10 network.

16. An apparatus according to claim 7, wherein
2 the superpacket stores single packet
3 occupation information representing whether a payload of
4 the superpacket is occupied by data of a single packet,
5 said forming means compares a length of each
6 packet with a length of the payload of the superpacket
7 and sets the single packet occupation information to
8 occupation ON or occupation OFF in accordance with a
9 comparison result, and
10 said reassembler means detects that the single
11 packet occupation information on the superpacket
12 represents occupation ON and links packet data on a
13 series of superpackets until an arrival of the
14 superpacket with the single packet occupation
15 information representing occupation OFF to reassemble
16 the original packet generated by said
17 transmission-source access network.

17 An apparatus according to claim 7, wherein a
2 header of the superpacket has the same format as that of
3 a header of the packet.

18. A packet communication system comprising:
2 an access network for transmitting/receiving a
3 packet;
4 said packet transfer apparatus of claim 7;
5 relay means for relaying the packet; and
6 a network serving as a backbone for
7 transferring a superpacket having a length n times (n is
8 an integer of not less than 2) larger than a
9 fixed-length cell as a switching unit of said relay
10 means,

11 wherein said packet transfer apparatus
12 performs mutual conversion between the packet
13 transmitted/received by said access network and the
14 superpacket transferred on said network and transfers
15 the packet transmitted from a transmission-source access
16 network to a destination access network in a form of the
17 superpacket through said relay means in said network.

19. A system according to claim 18, wherein
2 said packet transfer apparatus and said relay
3 means are assigned unique network addresses defined only
4 in said network, and
5 network addresses of packet transfer

6 apparatuses connected to said transmission-source and
7 destination access networks are stored in a header of
8 the superpacket as a transmission-source address and
9 destination address.

20. A system according to claim 19, wherein for
2 superpackets having the same destination packet transfer
3 apparatus, different network addresses are assigned to
4 destination addresses in headers of the superpackets in
5 accordance with a type of destination access network
6 connected to said destination packet transfer apparatus.

21. A system according to claim 19, wherein
2 said relay means comprises
3 a route search table which stores entries in
4 at least number corresponding to the numbers of said
5 packet transfer apparatuses and relay means, each entry
6 making a destination address in a header of the
7 superpacket correspond to a relay destination of the
8 superpacket, and
9 route search means for searching the route
10 search table on the basis of the destination address in
11 the header of the superpacket to specify the relay
12 destination of the superpacket.

22. A system according to claim 18, wherein for
2 the same network flow as a traffic, through said relay

